Emerging Standards for Product Development Applications

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Abstract

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National Institute of Standards and Technology

NIST strengthens the U.S. economy and improves the quality of life by working with industry to develop and apply technology, measurements, and standards.

NIST Assets:

- World leadership in measurement capabilities
- 3,200 employees
- $720 million annual budget
- 1,200 industrial partners
- 2,000 field agents
- 1,600 guest researchers
- $1.6 billion co-funding of industry R&D

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What is a Standard?

OMB Circular A-119, February 1998

- The definition of terms; classification of components; delineation of procedures; specification of dimensions, materials, performance, designs, or operations; measurement of quality and quantity in describing materials, processes, products, systems, services, or practices; test methods and sampling procedures; or descriptions of fit and measurements of size or strength.

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Why IT Standards?

Standards for information technology are technical rules providing the foundation that enable interconnected systems to work across activities, organizations, and geographic locations.

IT Standards Enable Interoperability

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Manufacturing Interoperability
Automotive Industry Example

Cylinder head requirements

Design data

Cylinder head

Translated design data

ERROR

Twice translated design data

Tooling

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Manufacturing Interoperability
Automotive Industry Example

What went wrong?

The data translations!

Lack of interoperability…

- 2 months spent identifying sources/nature of data translation errors
- Engineering services firm barred from bidding on manufacturer's projects during that time
- Tooling had to be scrapped and reworked
- New vehicle production delayed

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Interoperability Problems

- Maintenance of multiple engineering software systems to satisfy customer mandates
- Translation costs & inaccuracies
- Re-creating data to satisfy downstream application requirements
- Product delays

Cost of imperfect interoperability: $1B+ per year in the U.S. auto industry alone

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Interoperability Enables SBA

SBA Goal:

Integrated Product & Process Development (IPPD) Across the Entire Acquisition Lifecycle

Facts:

- Point-to-point integration of software supporting product and process development is excessively expensive
- Mandating specific vendor software systems pushes interoperability problems lower in the supply chain - it doesn't solve them

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NIST Efforts Addressing Interoperability

Assist industry via technical contributions to standards and deployment

- Cross industry perspective for standards harmonization
- Testing mechanisms
- Pilot participation
- R&D for new systems integration mechanisms

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IT Standards Making Bodies

Some voluntary, consensus organizations:

- American National Standards Institute (ANSI)
- Association Connecting Electronics Industries (IPC)
- International Organization for Standardization (ISO)
- Internet Engineering Task Force (IETF)
- Object Management Group (OMG)
- Open Applications Group (OAG)
- Organization for the Advancement of Structured Information Standards (OASIS)
- RosettaNet
- UN/CEFACT
- World Wide Web Consortium (W3C)

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Types of IT Standards

Infrastructure

- Examples
  - Express
  - eXtensible Markup Language (XML)
  - Integration Definition for Function Modeling (IDEF)
  - Unified Modeling Language (UML)

Content

- Examples
  - Initial Graphics Exchange Specification (IGES)
  - Electronic Design Interchange Format (EDIF)

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Emerging Content Standards by Domain

Three domains NIST is involved in:

- Mechanical Engineering/Manufacturing
- Electronics Engineering/Manufacturing
- Shipbuilding

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Mechanical Engineering

- ISO TC184/SC4
- OMG Manufacturing Domain Taskforce

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Emerging ISO TC184/SC4 STEP Standards (Application Protocols)

New/Preliminary Work Items

- AP for Rapid Prototyping and Layered Manufacturing
- AP for Computational Fluid Dynamics
- AP 219 - Exchange of Dimensional Inspection Information
- AP 238 - STEP NC

[Draft] International Standards

- AP 209 - Composite And Metallic Structural Analysis And Related Design
- AP 214 - Core Data For Automotive Design Processes
- AP 232 - Technical Data Packaging Core Information and Exchange

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LOCKHEED MARTIN

STEP is being used in production for streamlined data exchange with suppliers

- STEP adopted for all F-16 Military Fighter Aircraft production re-bid activities
- Recent major re-bid of F-16 machined parts:
  - Involved about 2300 part numbers and 50 potential suppliers
  - STEP provided **95%** reduction in printing and reproduction costs and **52%** reduction in labor by the prime contractor, not including similar savings by the suppliers
- Lockheed Martin plans to implement STEP across all new aircraft programs which use CAD (F-22, F-2, T-50, JSF, etc.) and at all sites in the consolidated Lockheed Martin Aeronautics Company

OMG Manufacturing Domain Taskforce

Product Data Management (PDM) Enablers

- Provide robust interfaces that enable the interoperability between PDM systems and a wide variety of other software systems.
- Provide a framework for PDM system interfaces that can be readily customized and extended by PDM technology providers, value added software suppliers, and end customers.
- PDME v1.3 adopted; v1.4 likely to be adopted July; v2.0 in proposal submission stage

CAD Services Interface

- Integrate CAD/CAE/CAM applications via CORBA interfaces
- Proposal submission stage

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Electronics Domain

STEP

- AP210 - Electronic Assembly, Interconnect, And Packaging Design

IPC/NEMI 25xx Series

- IPC 251x - GenCAM Product Data
- IPC 257x - Product Data Exchange (PDX)

NEMI Convergence Project

- Harmonize GenCAM, PDX, Valor's ODB++, others into one consistent standard

RosettaNet Product Information Cluster

- PIP 2A9 - Query Electronic Component Technical Information

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Shipbuilding

ISO STEP Efforts

- AP 212 - Electrotechnical Design & Installation
- AP 215 - Ship Arrangements
- AP 218 - Ship Structure
- AP 226 - Ship Mechanical Systems
- AP 227 (Edition 1) - Plant Spatial Configuration
  - Navy requiring delivery of piping information using AP 227
- AP 227 (Edition 2) - Adding HVAC representations

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Conclusion

Content standards address interoperability problems, but...

- Confusing standards situation - lots of standards efforts, more every week
- Conflicting and/or overlapping standards
- Complexity of content standards is an impediment to implementation
- Software vendors tend to wait for obvious groundswell of customer need
- Effectiveness of standards depends on widespread adoption and quality of implementation

Is there a better solution to interoperability?

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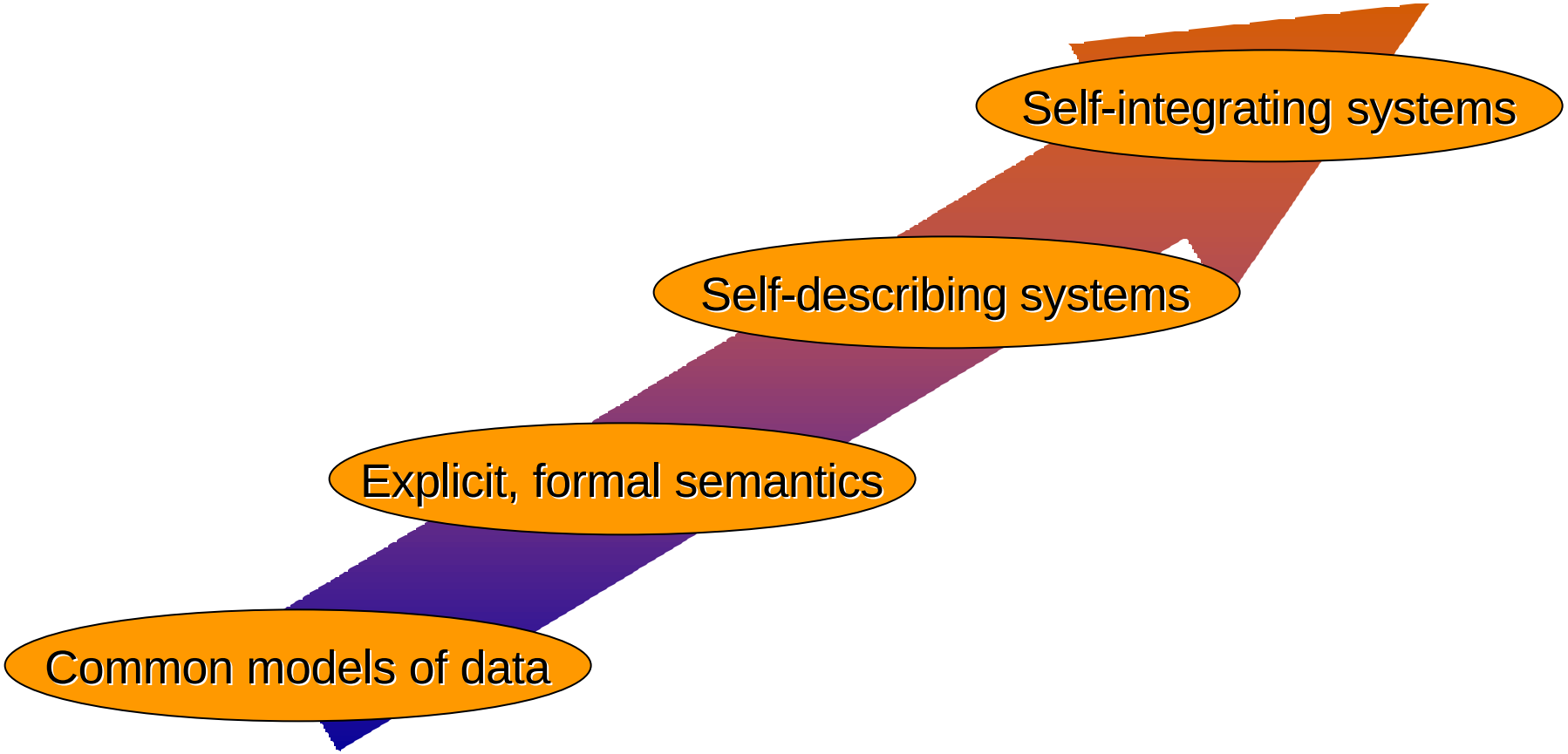
Evolution of Integrated Data Exchange



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Some Useful References

NIST efforts addressing manufacturing interoperability

- www.nist.gov/sima/

Study assessing costs of interoperability in auto sector

- www.rti.org/publications/cer/7007-3-auto.pdf

Standards development efforts discussed

- IPC 25xx Efforts - www.gencam.org
- ISO STEP Shipbuilding Team - www.nsnet.com/NIDDESC/t23.html
- NASA STEP Tutorials - step.jpl.nasa.gov/step/workshop.html
- Navy/Industry Data Exchange -www.nsnet.com/NIDDESC/
- NEMI Convergence Project - www.nemi.org/Projects/DEC/index.html
- OMG Mfg Domain Taskforce -www.omg.com/homepages/mfg/index.html
- PDES, Inc. - pdesinc.aticorp.org
- RosettaNet - www.rosettanet.org

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